

13-2

How is density measured?

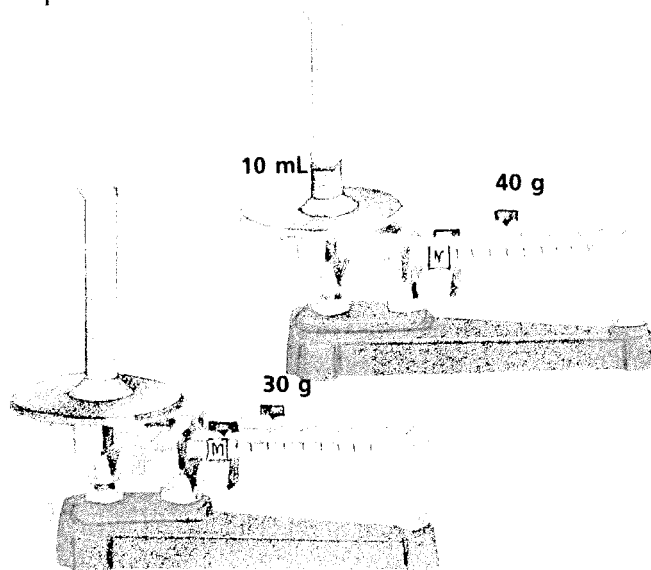
Objective ► Explain how to find the density of a solid or a liquid.

Finding Density In order to find the density of a substance, you must measure both mass and volume. You can find density by dividing the mass by the volume. Remember that mass is measured in grams. Volume is measured in cubic centimeters. Density is expressed in grams per cubic centimeter or grams per milliliter.

$$\text{density} = \text{mass/volume}$$

► **Identify:** What measurements must you make before you can calculate the density of a substance?

Density of a Liquid You can find the density of a liquid using a graduated cylinder and a balance. First, find the mass of the graduated cylinder alone. Record your measurement. Next, pour some of the liquid you want to measure into the graduated cylinder. Write down the volume of the liquid. Place the graduated cylinder with the liquid on the balance. Record the mass. Then find the mass of the liquid. To find the mass of the liquid, subtract the mass of the empty graduated cylinder from the mass of the graduated cylinder with liquid.



Now you are ready to calculate the density of the liquid. Look at the example shown. The mass of the liquid is 10 g. The volume is 10 mL. To find the liquid's density, divide its mass by its volume.

$$\text{density} = \text{mass/volume}$$

$$\text{density} = 10 \text{ g}/10 \text{ mL}$$

$$\text{density} = 1 \text{ g/mL}$$

Notice that in this example, density is measured in grams per milliliter. One milliliter is equal to one cubic centimeter. The density of a liquid can be measured in g/mL or g/cm³.

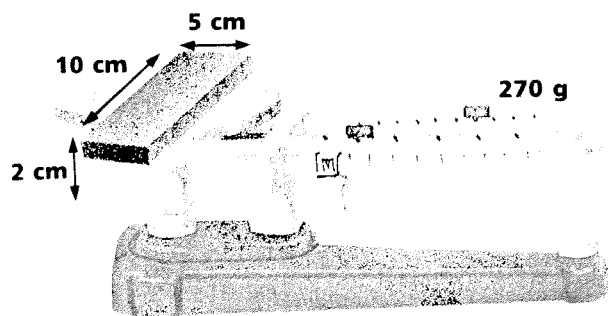
► **Explain:** Why can density be measured either in g/cm³ or in g/mL?

Density of a Solid You can find the density of any solid if you know its mass and volume. You can use a balance to find the mass of a solid. You can find the volume of a solid with a regular shape by multiplying its length by its width by its height. Look at the aluminum bar. Its mass is equal to 270 g. Its volume is equal to 10 cm × 5 cm × 2 cm, or 100 cm³. To find the density of the aluminum bar, divide its mass by its volume.

$$\text{density} = \text{mass/volume}$$

$$\text{density} = 270 \text{ g}/100 \text{ cm}^3$$

$$\text{density} = 2.7 \text{ g/cm}^3$$

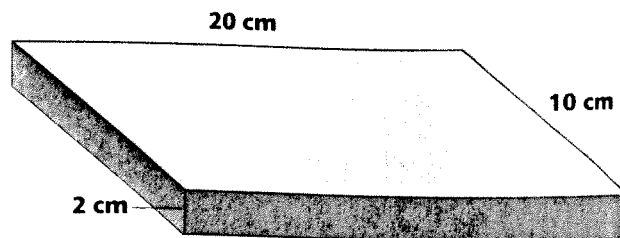


► **Describe:** How can you find the volume of a solid with a regular shape?

LESSON SUMMARY

- Density is equal to mass divided by volume.
- The density of a liquid can be measured in g/mL or g/cm³.
- To find the density of a solid with a regular shape, measure its mass and find its volume by multiplying its length by its width by its height.

Use the diagram to answer the questions.



CHECK Complete the following.

1. What measurements must be known in order to find the density of a substance?
2. What are the units of density for a liquid?
3. What equipment do you need to find the density of a liquid?
4. What three measurements must you make when finding the density of a liquid?
5. How can you find the density of a solid with a regular shape?

APPLY Complete the following.

6. **Calculate:** If 5 mL of a liquid have a mass of 10 g, what is the density of the liquid?
7. When finding the density of a liquid, why must you first find the mass of a graduated cylinder alone?

8. What is the volume of the bar?

9. If the bar has a mass of 5 grams, what is its density?

Skill Builder

Analyzing Gold was discovered in California in 1848. Many people went West to look for gold and become rich. One problem they had in hunting for gold was a substance known as fool's gold. Fool's gold looks like gold, but it is really a compound of iron and sulfur and sometimes copper. The density of real gold is 19.3 g/cm³. The density of fool's gold is about 5 g/cm³. If you were searching for gold, how could you tell whether a material was real gold or fool's gold?

Activity

You will need a graduated cylinder, water, corn syrup, vegetable oil, and glycerine.

1. One at a time, slowly pour the water, corn syrup, vegetable oil, and glycerine into the graduated cylinder.
2. Observe the liquids as they form separate layers.
3. **Model:** Make a sketch showing the order in which the liquids have settled in the graduated cylinder.

Questions

1. **Relate:** What caused the liquids to separate into layers?
2. a. Which liquid is the most dense? b. Which liquid is the least dense?
3. List the four liquids in order from least to most dense.

